

CLAIMS

What is claimed is:

1. A composition comprising a mixture containing:
 - (a) an enzyme possessing substantial 3'-5' exonuclease activity, and
 - (b) a DNA polymerase, wherein said polymerase has less 3'-5' exonuclease activity than said enzyme.
2. A composition according to Claim 1, wherein said enzyme is a DNA polymerase.
3. A composition according to Claim 1, wherein said polymerase and said enzyme possessing substantial 3'-5' exonuclease activity are thermostable.
4. A composition according to Claim 3, wherein said enzyme possessing substantial 3'-5' exonuclease activity is a DNA polymerase.
5. A composition according to Claim 3, wherein said DNA polymerase substantially with less 3'-5' exonuclease activity is Taq polymerase.
6. A composition according to claim 1, wherein said enzyme possessing substantial 3'-5' exonuclease activity is selected from the group consisting of *Pfu* polymerase, E. coli DNA polymerase I, Klenow fragment, T-4 polymerase, T-7 polymerase, Vent polymerase, and Deep Vent polymerase.
7. A composition according to claim 3, wherein said enzyme possessing substantial 3'-5' exonuclease activity is selected from the group consisting of *Pfu* polymerase, Vent polymerase, and Deep Vent polymerase.
8. A composition according to Claim 5, wherein said enzyme possessing substantial 3'-5' exonuclease activity is *Pfu* polymerase.

9. A method of synthesizing a polynucleotide comprising the step of mixing a composition according to claim 1 with a synthesis primer, and a synthesis template.
10. A method according to Claim 9, wherein said enzyme possessing substantial 3'-5' exonuclease activity is a DNA polymerase.
11. A method according to Claim 9, wherein said polymerase and said enzyme possessing substantial 3'-5' exonuclease activity are thermostable.
12. A method according to Claim 11, wherein said enzyme possessing substantial 3'-5' exonuclease activity is a DNA polymerase.
13. A method according to Claim 11, wherein said DNA polymerase with less 3'-5' exonuclease activity is Taq polymerase.
14. A method according to claim 9, wherein said enzyme possessing substantial 3'-5' exonuclease activity is selected from the group consisting of *Pfu* polymerase, *E. coli* DNA polymerase I, Klenow fragment, T-4 polymerase, T-7 polymerase, Vent polymerase, and Deep Vent polymerase.
15. A method according to claim 11, wherein said enzyme possessing substantial 3'-5' exonuclease activity is selected from the group consisting of *Pfu* polymerase, Vent polymerase, and Deep Vent polymerase.
16. A method according to Claim 13, wherein said enzyme possessing substantial 3'-5' exonuclease activity is *Pfu* polymerase.
17. A method of amplifying a polynucleotide sequence in a cyclic amplification reaction, said method comprising, synthesizing a polynucleotide by the method of Claim 9.

18. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 10.
19. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 11.
20. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 12.
21. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 13.
22. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 14.
23. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 15.
24. A method of amplifying a polynucleotide sequence with a cyclic amplification reaction said method comprising, synthesizing a polynucleotide by the method of Claim 16.
25. A kit for the synthesis of a polynucleotide, said kit comprising, a mixture containing:

- (a) a DNA polymerase, wherein said polymerase is substantially with less 3'-5' exonuclease activity, and
(b) an enzyme possessing substantial 3'-5' exonuclease activity.

26. A kit according to Claim 25, wherein said enzyme possessing substantial 3'-5' exonuclease activity is a DNA polymerase.

27. A kit according to Claim 25, wherein said polymerase and said enzyme possessing substantial 3'-5' exonuclease activity are thermostable.

28. A kit according to Claim 27, wherein said enzyme possessing substantial 3'-5' exonuclease activity is a DNA polymerase.

29. A kit according to Claim 27, wherein said DNA polymerase substantially with less 3'-5' exonuclease activity is Taq polymerase.

30. A kit according to claim 25, wherein said enzyme possessing substantial 3'-5' exonuclease activity is selected from the group consisting of *Pfu* polymerase, *E. coli* DNA polymerase I, Klenow fragment, T-4 polymerase, T-7 polymerase, Vent polymerase, and Deep Vent polymerase.

31. A kit according to claim 28, wherein said enzyme possessing substantial 3'-5' exonuclease activity is selected from the group consisting of *Pfu* polymerase, Vent polymerase, and Deep Vent polymerase.

32. A kit according to Claim 29, wherein said enzyme possessing substantial 3'-5' exonuclease activity is *Pfu* polymerase.

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